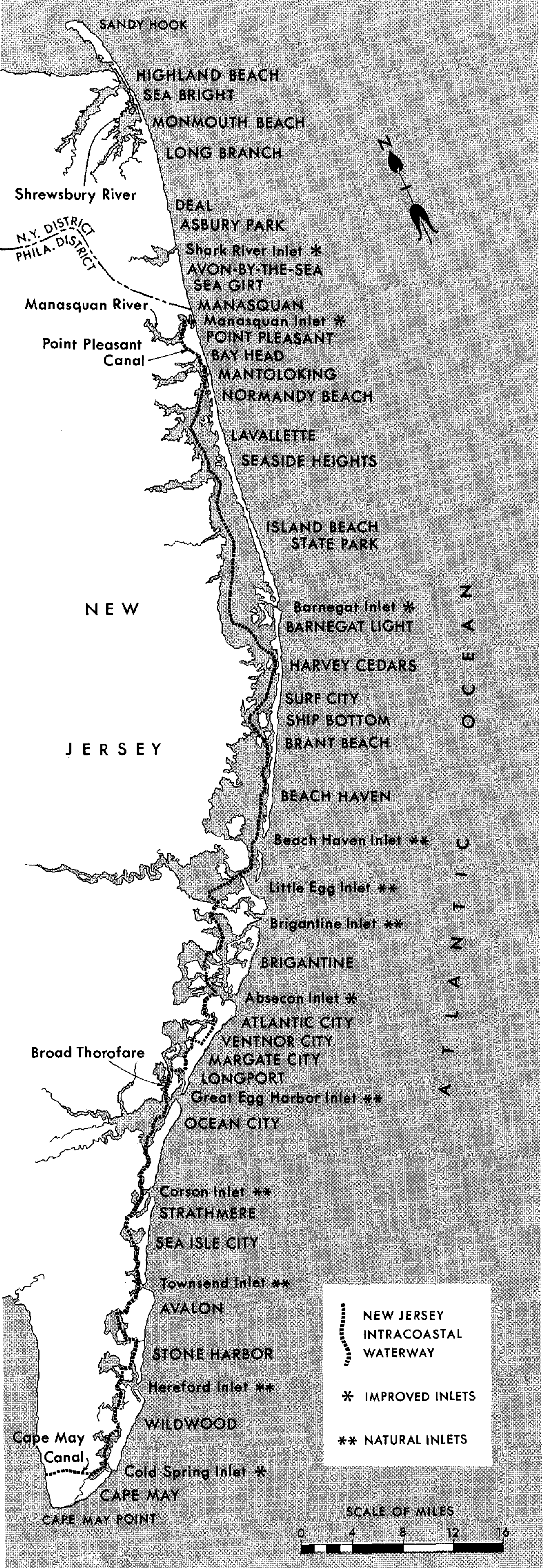


PRESERVING A COASTLINE

On the map, the seacoast of New Jersey is depicted as a finely-fretted contour, loosely girdled by a delicate, fragmented pattern of islands and barrier beaches. It appears and is fragile and vulnerable. Constantly exposed to wave action, gale winds and tidal currents, its precious sands migrate perpetually. Its one unique asset — the miles of glistening white sand beach — is also its most erratic and unstable feature. This shifting material constitutes the basic natural element in the predominantly recreation-oriented economy of the New Jersey seashore; together with surf and sun it draws an annual average of seven summer residents for each local inhabitant, beyond the countless transients who "week-end" at the shore.

The tenuous barrier islands exhibit a precarious semblance of permanence. Now densely covered by real estate development, they were, within the memory of living residents, a nearly-continuous chain of large, grassy dunes. Many inlets were etched into the barriers by wave action across their narrow width—at least 21 above Barnegat; now there are two inlets in that reach and only 12 in the entire New Jersey coast. The regimen of the inlets is inseparably linked with the beaches. Inlets tend to migrate; to disappear and reappear; hopefully, they may be trained to the role of beach feeders as well as navigation channels. A new inlet may be cut through the neck of Sandy Hook near the mouth of the Shrewsbury River; another, to bisect Island Beach, has been proposed.

The new plans call for modification of the old inlets by providing sand bypassing systems at the updrift jetties. Extensive changes are planned for Barnegat, the oft-reworked

Barnegat Light.

"problem" inlet, where vast shoaling occurs and sand accretion exceeds that of all other New Jersey inlets. The first jetties were built there between 1938 and 1940; a House Document of 1892 reported unfavorably on a proposal to create a harbor of refuge at Barnegat Inlet. Protection for Barnegat Light through the years has required countless projects funded by the State and Federal governments for construction of bulkheads, groins and revetments. The light, designed by Captain George Meade, was installed in 1858 by the Lighthouse Board.

The District Engineer has recommended the installation of jetties at Hereford Inlet and the maintenance of a navigation channel between the ocean and the Intracoastal Waterway. Dredged channels and channel markers are proposed for the wide-open reaches of Beach Haven and Little Egg Inlets, where navigable depths are hard to find in heavy seas. Any decision about jetties there, awaits the results of studies in progress in 1971 at the Waterways Experiment Station. Absecon Inlet, near one of the country's most popular resort areas, requires maintenance dredging to facilitate navigation; the volume of material removed from that channel by Corps hopper dredge averages 240,000 cubic yards annually.

Cold Spring Inlet is guarded by two stone jetties constructed between 1908 and 1911. The channel gives access from the ocean to Cape May Harbor and to Delaware Bay via the Cape May Canal. Connection is made in Cape May Harbor with the New Jersey Intracoastal Waterway at its original southernmost terminus. The east jetty diverts the down-drifting sands and influences the wave scour of Cape May Point. Around the point on the western shore, up to the Cape May Canal entrance, accretion rates have increased since 1948.

Manasquan Inlet, 96 nautical miles up the Intracoastal Waterway from Cape May Harbor, is the oldest of the improved New Jersey inlets. At this point the coastline has receded more than 300 feet since 1879, when an inlet project was approved and $12,000 appropriated for construction of timber crib jetties. (See "Inland Waterway," p. 91) Here, the net direction of littoral drift is northward, the south jetty is on the updrift side and is flanked with sand almost to its outer tip. The situation, here, is essentially the same as with all the jetties: while effectively aiding navigation, these projecting structures entrap the shifting sand and create problems of beach and channel maintenance.

Beach loss by littoral sand transport and shore damage from storms always occurred, but efforts to control it are of relatively recent origin and are tied to the pressures of an increasing population in the Northeast Corridor and its expanding recreational needs. Control of beach erosion was attempted at Ocean City in 1907 and at other South Jersey resorts between 1915 and 1929 by the efforts of municipal, State and Federal agencies and by private interests. In 1922 the State of New Jersey began an extensive program of assistance to shore communities

Manasquan Inlet

and issued a Report on the Erosion and Protection of New Jersey Beaches, prepared by its Board of Commerce and Navigation. Other studies, examinations and reports followed: in 1933, by the Beach Erosion Board; in 1949, by the State Beach Erosion Commission of New Jersey; from 1945 to 1965, four reports on flood and beach erosion control and improvements of navigation, by the Corps of Engineers. The Philadelphia District prepared a detailed interim report covering New Jersey Coastal Inlets and Beaches - Great Egg Harbor Inlet to Stone Harbor, which was published as House Document No. 91-160 on 17 September 1969. These studies were the product of extensive inter-agency collaboration.

It wasn't all language; money was spent on measures to correct, protect and prevent, and on surveys leading to a better understanding of the idiosyncrasies of littoral drift. However, not all of the new techniques were universally beneficial. Groin construction undertaken by some communities damaged the beaches of their down-drift neighbors; some ill-placed storm bulkheads accelerated erosion. Development of shore-front property increased as its availability dwindled, with consequent encroachment of the storm wave zone and loss of the dunes as natural storm barriers. The installation of revetted stone seawalls for storm protection was a desperate measure, but fully one-third of the beachfront communities along the 126 mile shoreline constructed seawalls or solid bulkheads behind their beaches. The problem differed from one locality to another. Varied patterns of sand migration were revealed in studies by the Coastal Engineering research Center. In the "nodal zone," Point Pleasant to Seaside Heights, depletion of the shoreline was seen to be less than for the reach above to Sandy Hook. The southwestward drift below Barnegat Inlet deposited the transported material at the lower extremities of the barrier beaches. There, the inlets became shoaled inside the mouth or at the downdrift side of the entrance.

The use of groins to train shorelines has been practiced for many years. The technique has its confirmed advocates and opponents. As applied on the New Jersey beaches, groining has yielded mixed results. Best results appear to have been obtained where sufficient breadth of local cooperation has permitted comprehensive, rather than piecemeal, solutions and, of course, where the littoral transport brings an adequate supply of sand. Eventually, groin fields designed as components of the whole coastal regimen may vindicate the method by retaining a major portion of the trapped sand. This is highly desirable, in view of the increasing scarcity and high cost of suitable material obtainable by man's efforts. Meanwhile, the installation of groins continues, the instances of their effectiveness are observable in many places.

Beyond beach stabilization, local communities sought to protect homes and other property from storm damage and to provide navigational aids for the vast numbers of

Timber groins at Rehoboth Beach, Delaware. Damage to shore-front properties was caused by the "Five-High" storm of March, 1962.

pleasure boats and fishing craft plying local waters. Jetty designs tried to incorporate the needs of navigation, erosion control and recreation. Inlet channels, protected by two jetties, were to be self-maintaining; updrift jetties would function as depository basins for down-shifting sands, which could be moved by dredge to denuded, downshore beaches. The bulkheads contiguous to inlet jetties were supplemented with parking areas and other features to facilitate sport fishing.

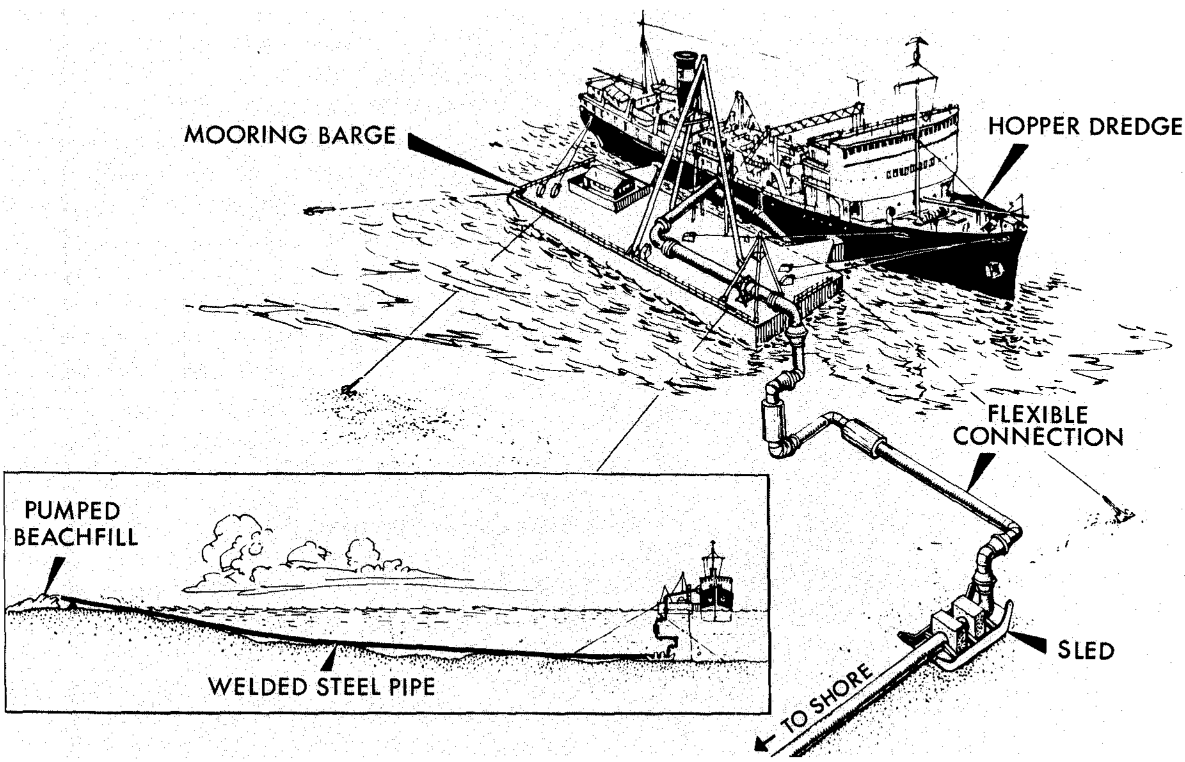
The practice of replenishing depleted beaches by hauling in sand from borrow areas is not an old one, but is undeniably effective and is gaining currency. Transport methods to economically replace the dump truck and provide a greater volume of suitable quality sandfill are under study in the District. The capability to transport sand hydraulically through pipelines, employing powerful dredge pumps is well proven. The combination being sought will include accessible borrow areas, acceptable material and a pumping system that is flexible and economical. Bottom material taken from the lagoons and thorofares inside the barrier islands proved convenient and satisfactory while it lasted. As of 1971, usable beachfill was becoming scarce; much of the potential borrow material contained refuse or pollutants, or could not be removed without risking destruction of marine life spawning grounds. Large deposits of fine white sand have been located offshore in ocean depths of 30 to 50 feet; some of this sand found its way to a Jersey beach in the Spring of 1966 by way of a unique experiment conducted by the District's Operations Division at Sea Girt.

Beach nourishment was in the minds of District planners when they devised the direct pumpout system for Delaware River channel maintenance dredging in 1963 ("Dredging the Delaware," p.184). The basic tools of the system were employed in the Sea Girt experi-

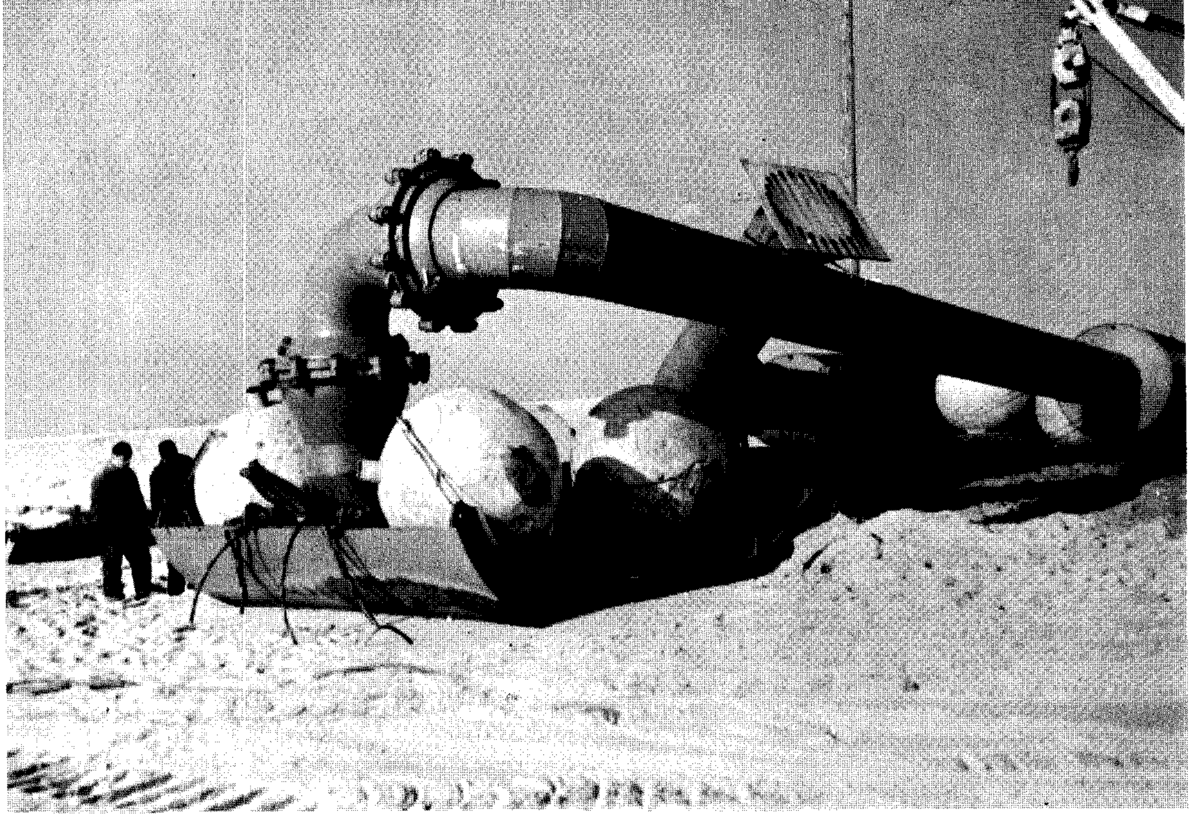
Beach nourishment at Sea Girt.

ment - seagoing hopper dredge, mooring barge, pipeline and tug - with significant modifications. The pipeline and its deployment through ocean waves to surf-beaten strand presented problems essentially different from those of a delivery system used in relatively placid estuarine waters. Instead of the floating pipeline of the river system, a 2,000 foot-long welded steel pipeline, 28 inches in diameter was laid on the ocean floor, extending off- shore to a 40-foot depth, there to link up with the mooring barge by means of a flexible connection assembly. Initially, it was intended to tow the pipeline by flotation and sink it into position. That plan was scuttled after the first attempt was frustrated by skittish weather, and the rig was towed out along the bottom.

The mooring barge (MB-2) was readied for sea duty by the addition of wave-measuring instrumentation and heavy timber bulkheading around the deck house. Ten anchors, weighing between 2,500 and 8,000 pounds held MB-2 in her mooring, and Corps Tug San Luis II stood by in case the barge should encounter difficulty with heavy seas. Hopper Dredge Goethals made her dredge runs over a heavy deposit of white sand just south of Asbury Park (about 15 miles, round trip) dragging up a 5,500 cubic yard load on each



The Sea Girt experiment employed the basic tools of the Direct Pumpout Dredging technique. Essentially different was the design of a discharge pipeline to withstand the stresses of ocean current and wave action. Instead of the floating discharge line used in more tranquil waters, a continuous welded steel pipe, flexibly adjoined to the mooring barge, was installed on the ocean floor.



The flexible connection, folded and ready to be towed into the Atlantic, "looked like the work of a drunken plumber," according to an observer; it was fabricated especially for the experiment. Other elements of the operation, except the 2,000-foot discharge pipe, were regular units of the Corps' floating plant.

trip. After 24 loads, a 1,000-foot length of beach was elevated five feet and the waterline was pushed nearly 200 feet seaward.

The experiment proved the feasibility of delivering a large volume of select material by pumping through a hydraulic discharge system. It did not prove that beach nourishment was inexpensive. The plant performed without significant difficulty in seas with wave heights of four to five feet. Higher waves twisted the flexible connection beyond tolerable limits and made berthing of the dredge extremely precarious. The operation was a preliminary step in a maintenance program which, realistically appraised, must be regarded as continuing and permanent. Since the sand beach is a basic factor in the resort seashore economy, its preservation appears to be an elementary fact of life.

To date, a generally effective technique for beach stabilization has not been evolved. Establishment of dumped off-shore feeder beaches, ostensible depots for the natural transport system of the littoral drift, has been ineffective. It is apparent that where beach sand is needed, there it must be placed by man's efforts. One scheme, under study in 1971, is to dump selected material in established offshore spoil areas, where submerged pumping installations would pick up and deliver sand to the beaches through flexible discharge lines. Essentially automated, such a scheme if feasible could make beach nourishment economically tolerable.

District studies, continuing through 1971 and carried out in coordination with other Federal agencies and with agencies of the State of New Jersey sought formulation of "a comprehensive plan to meet the long-term needs of the Atlantic Coast of New Jersey." The studies were divided into four sections, each covering a physiographic segment of the Atlantic coastline. The groupings predicate integral relationships between beaches and inlets. Priorities for recommended improvement projects will be designated to accord with State of New Jersey criteria. Programs which the District Engineer will recommend are designed to benefit navigation, curtail beach erosion, nourish beaches, restore and stabilize dunes and provide some measure of storm protection. To these ends construction of new structures will be recommended and many existing structures will be rehabilitated.

The preservation of a shoreline for coastal New Jersey will benefit the economic life of the entire community. It is therefore incumbent upon the community to carry out a consistent and major role in determining and funding the appropriate solutions. What seems particularly important is the kind of collaboration which makes possible a broad, integrated plan. Pre-authorization costs (surveys; studies; reports) are borne by the Federal Government; costs for authorized projects are shared between local interests (municipalities, counties, states) and the United States. Federal participation is apportioned up to 70 percent. Much well-intended effort has been expended to preserve the coastline, from early privately-funded works to public works programs such as those enacted by the Works Progress Administration (WPA, 1935), the Accelerated Public Works program (APW, 1963) and many others undertaken by the State of New Jersey and the Corps of Engineers.

Faced by the distinctly local problem of a shifting shoreline, we must first gain more knowledge of sand migration patterns—how much material is transported and what it is like; how much material is eroded away, why it is eroded and what becomes of it. In search for the place of origin of littoral drift, careful investigation of the composition of beaches and comparison of beach particles with those of contiguous streams, bays and near-shore bottoms was made. No external feeder source could be authenticated—the only significant natural source of littoral material appears to be the beach itself.